AMENDMENTS TO THE CLAIMS

1. (currently amended) A method ~~to disaggregate~~ comprising disaggregating asphaltenes in a petroleum oils and ~~oil~~ mixtures of petroleum oils, feedstream and/or refinery process streams ~~comprising~~ by mild heating of said petroleum oils and mixtures of petroleum oils, feedstream and/or refinery process streams, the disaggregated asphaltenes remaining soluble in the petroleum oil and mixtures of petroleum oils feedstream and/or refinery process streams.

2. (currently amended) The method of claim 1 further comprising the step of determining the presence of asphaltene aggregates by irradiating said petroleum oils and ~~oil~~ mixtures of petroleum oils, feedstream and/or refinery process streams with neutrons and determining small angle neutron scattering (SANS) intensity, I, as a function of wavenumber, q, wherein said scattering intensity includes a coherent component and an incoherent component.

3. (currently amended) The method of claim 2 wherein said neutron scattering wavenumber, q, is in the range 10^{-4} Å^{-1} $\leq q \leq$ 1 Å^{-1}, ~~preferably 10^{-3} Å^{-1} $\leq q \leq 10^{-1}$ Å^{-1}~~.

4. (currently amended) ~~A~~ The method of claim 3 wherein ~~to determine~~ the ~~regimes of~~ compatibility and incompatibility of petroleum oils and mixtures of petroleum oils and/or refinery process streams are determined ~~using~~ fitting of $I(q)$ ~~in claim 2~~ to an equation based on a physical model that contains coherent components, ~~contributions~~ a strongly decaying component ~~feature~~ to describe the surface scattering of asphaltene aggregates at the ~~low~~ q, near its lower range (low-q), a plateau ~~feature~~ component with a rolloff for ~~at higher~~ q near its upper range (high-q) to describe the asphaltene particles, and a constant to describe the ~~high~~ q incoherent ~~scattering~~ component.

5. (currently amended) The method of claim 4 wherein the equation is given by ~~Equation (1).~~

$$I(q) = I_{incoh} + I_{L} / \left(1 + q^2 \xi^2\right) + I_{surf}\left(q / q_1\right)^{-\alpha}$$

wherein, I_{incoh} is the constant high-q incoherent scattered neutron intensity, I_{L} is the low-q plateau intensity of the Lorentzian (second term), ξ is the correlation length (proportional to the radius of gyration of an asphaltene particle), I_{surf} is the low-q value of the intensity due to surface scattering from asphaltene aggregates, α is the absolute value of the logarithmic slope of $I(q)$ at low q, and q_1 is fixed by the lowest q in the range.

6. (currently amended) The method of claim 5 wherein ~~the criterion for~~ incompatibility is determined by the concavity of the low-q plateau intensity of the asphaltene particles, I_{L}, as a function of the volume fraction of mixing, ϕ_m.

7. (currently amended) The method of claim 5 wherein ~~the criterion for~~ incompatibility is determined by the systematic deviation of I_{L}, as a function of mixing volume fraction from ~~the~~ a hard sphere prediction ~~given by Equation (2).~~

8. (currently amended) The method of claim 5 wherein ~~the criterion for~~ incompatibility is determined by ~~the~~ a maximum in the correlation length, ξ ~~given by Equation (2).~~

9. (currently amended) The method of claim 5 wherein ~~the criterion for~~ incompatibility is determined by the dominance of the low-q value of the surface

scattering intensity, I_{surf}, over the sum of the low-q plateau intensity of the asphaltene

particles, I_L, and the incoherent scattering intensity, I_{incoh}.

10. (currently amended) The method of claim 5 wherein ~~the criterion for~~

incompatibility is determined by the power law exponent, α, exceeding a value of three.

11. (currently amended) A method to estimate the volume fraction of

asphaltene aggregates, ϕ_{agg}, in incompatible petroleum oil and/or refinery process

stream mixtures ~~based on~~ <u>comprising determining the</u> ~~a~~ difference between I_L, the

low-q plateau intensity corresponding to the asphaltene particles, ~~I_L, determined in~~

~~claim 5 at different volume fractions of mixing, ϕ_m,~~ and ~~a prediction for the behavior of~~

~~this~~ I_{HS}, the intensity ~~expected~~ for ~~spherical particles interacting by contact repulsions~~

<u>perfect hard spheres in the absence of aggregation, wherein I_L, and I_{HS} are determined</u>

<u>at different volume fractions of mixing ϕ_m.</u>

12. (currently amended) The method of claim 11 wherein the equation to

estimate the volume fraction of <u>asphaltene</u> aggregates, ϕ_{agg}, is given by ~~Equations (2)~~

~~and (3)~~ <u>the difference between the measured valve of I_L (ϕ_m) and the IL (ϕ_m) for perfect</u>

<u>hard spheres in the absence of aggregation.</u>

13. (currently amended) The method of claim ~~2~~ <u>5</u> wherein the total

surface area of asphaltene aggregates per unit volume of the petroleum oil, S_V, is

determined from the ~~amplitude of the~~ surface scattering intensity, I_{surf}, ~~from asphaltene~~

~~aggregates~~ at low wavenumbers, q.

14. (currently amended) The method of claims 12 ~~and 13~~ wherein the

average length scale, R, associated with the internal structures of the asphaltene

aggregates is ~~estimated using Equation (4)~~ <u>determined from the ratio of the volume</u> <u>fraction of asphaltene aggregates and the total surface area of asphaltene aggregates,</u> <u>wherein the total surface of asphaltene aggregates per unit volume of the petroleum oil,</u> <u>S_V is determined from the surface scattering intensity, I_{surf} at low wavenumbers, q.</u>

15. (New) The method of claim 2 wherein said neutron scattering wavenumber, q, is in the range 10^{-3} Å$^{-1} \leq q \leq 10^{-1}$ Å^{-1}.

16. (New) The method of claim 1 wherein said heating is performed at a temperature between 40°C and 150°C for a time period of 1 minute to four weeks.

17. (New) The method of claim 1 wherein said heating is performed at a temperature range between 40°C and 100°C for a time period of 2 minutes to 24 hours.

18. (New) The method of claim 1 wherein said heating is performed at a temperature range between 40°C and 80°C for a time period of 3 minutes to 3 hours.

19. (New) The method of claim 1 wherein said heating is performed at a temperature range between 40°C and 60°C for a time period of 4 minutes to 1 hour.